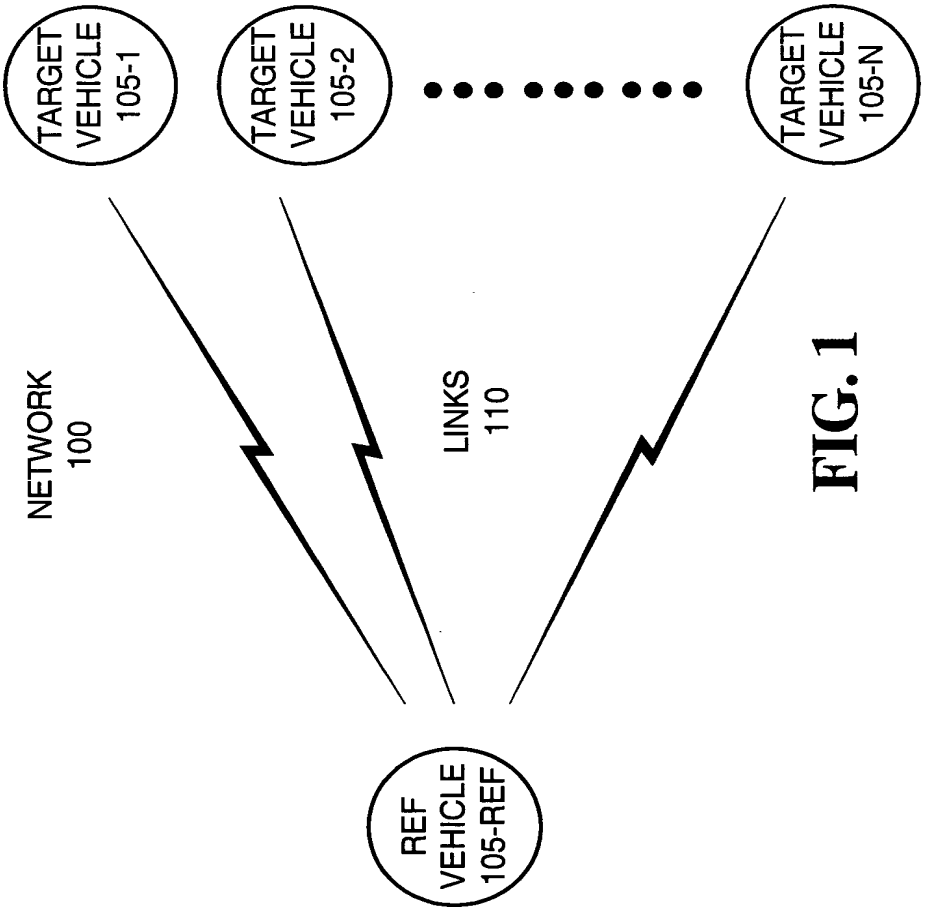
TARGET VEHICLE 105-1
TARGET VEHICLE 105-2
TARGET VEHICLE 105-N
NETWORK 100
LINKS 110
REF VEHICLE 105-REF

FIG. 1

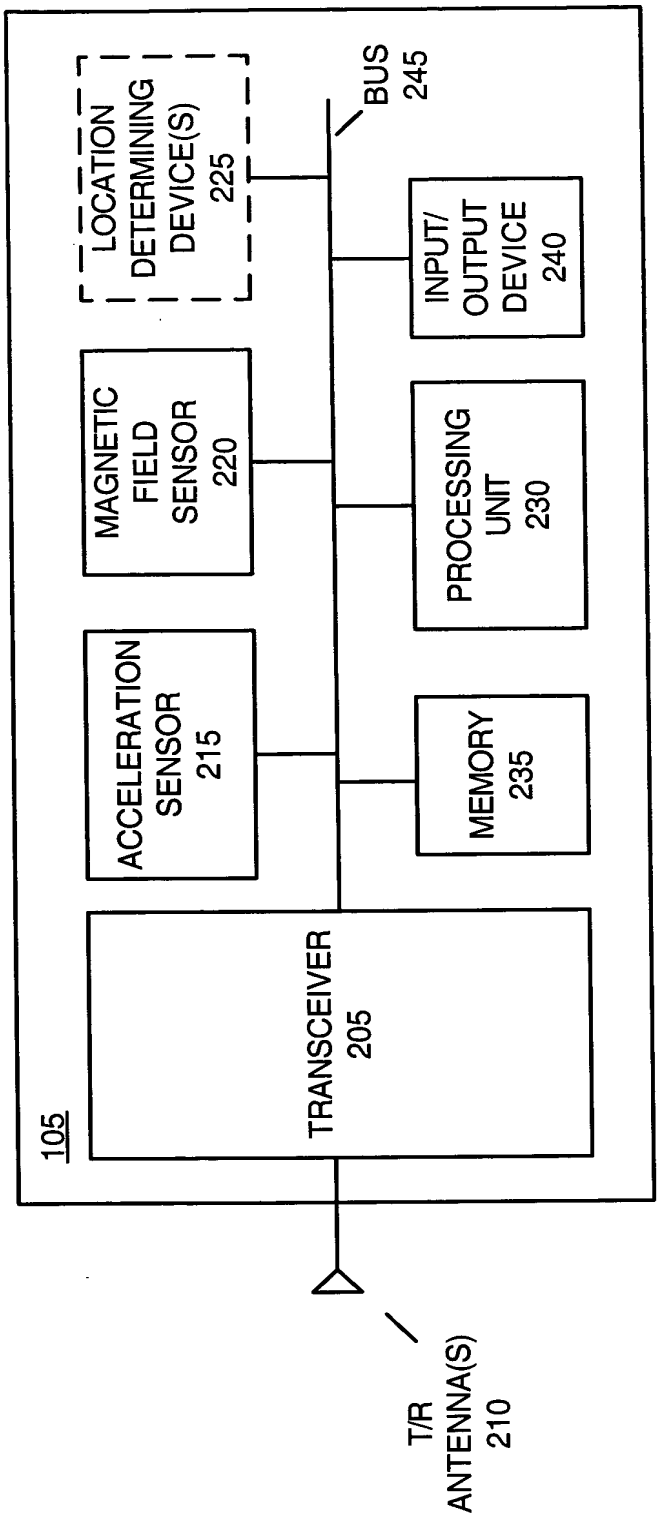
105
TRANSCEIVER 205
ACCELERATION SENSOR 215
MAGNETIC FIELD SENSOR 220
LOCATION DETERMINING DEVICE(S) 225
MEMORY 235
PROCESSING UNIT 230
INPUT/ OUTPUT DEVICE 240
BUS 245
T/R ANTENNA(S) 210

FIG. 2

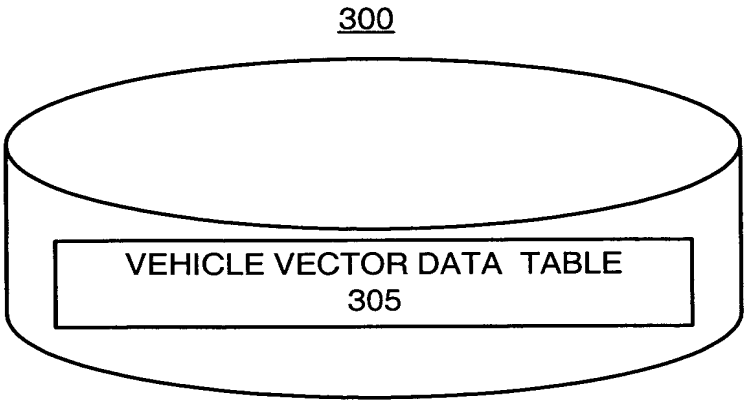

FIG. 3A

TABLE ENTRIES 310

VEHICLE VECTOR DATA TABLE 305

TARGET VEHICLE ID 315	$\vec{T}$ 320	$\vec{v}$ 325	$\vec{i}_{\vec{v}}$ 330	$\vec{g}$ 335	$\vec{i}_{\vec{g}}$ 340	$\vec{m}$ 345	$\vec{i}_{\vec{m}}$ 350	$\vec{i}_{N}$ 355	$\vec{i}_{\vec{E}}$ 360	$\vec{M}$ 365	$\vec{i}_{\vec{v}_{local}}$ 370
vehicle_id_1											
vehicle_id_2											
vehicle_id_3											
⋮	⋮	⋮		⋮				⋮			⋮
vehicle_id_N											

FIG. 3B

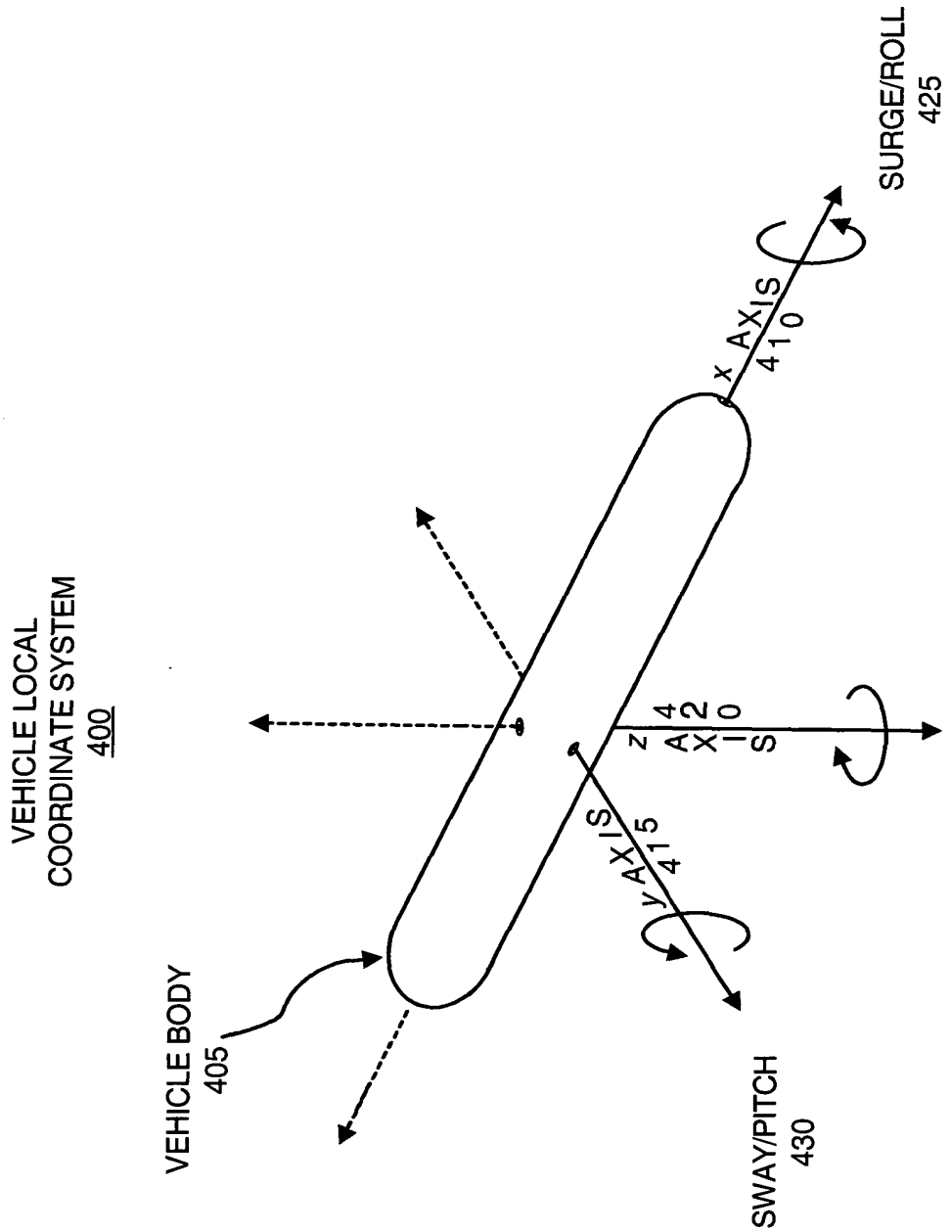
VEHICLE LOCAL
COORDINATE SYSTEM
400
VEHICLE BODY
405
x AXIS
410
y AXIS
415
z AXIS
420
SURGE/ROLL
425
SWAY/PITCH
430
HEAVE/YAW
435

FIG. 4

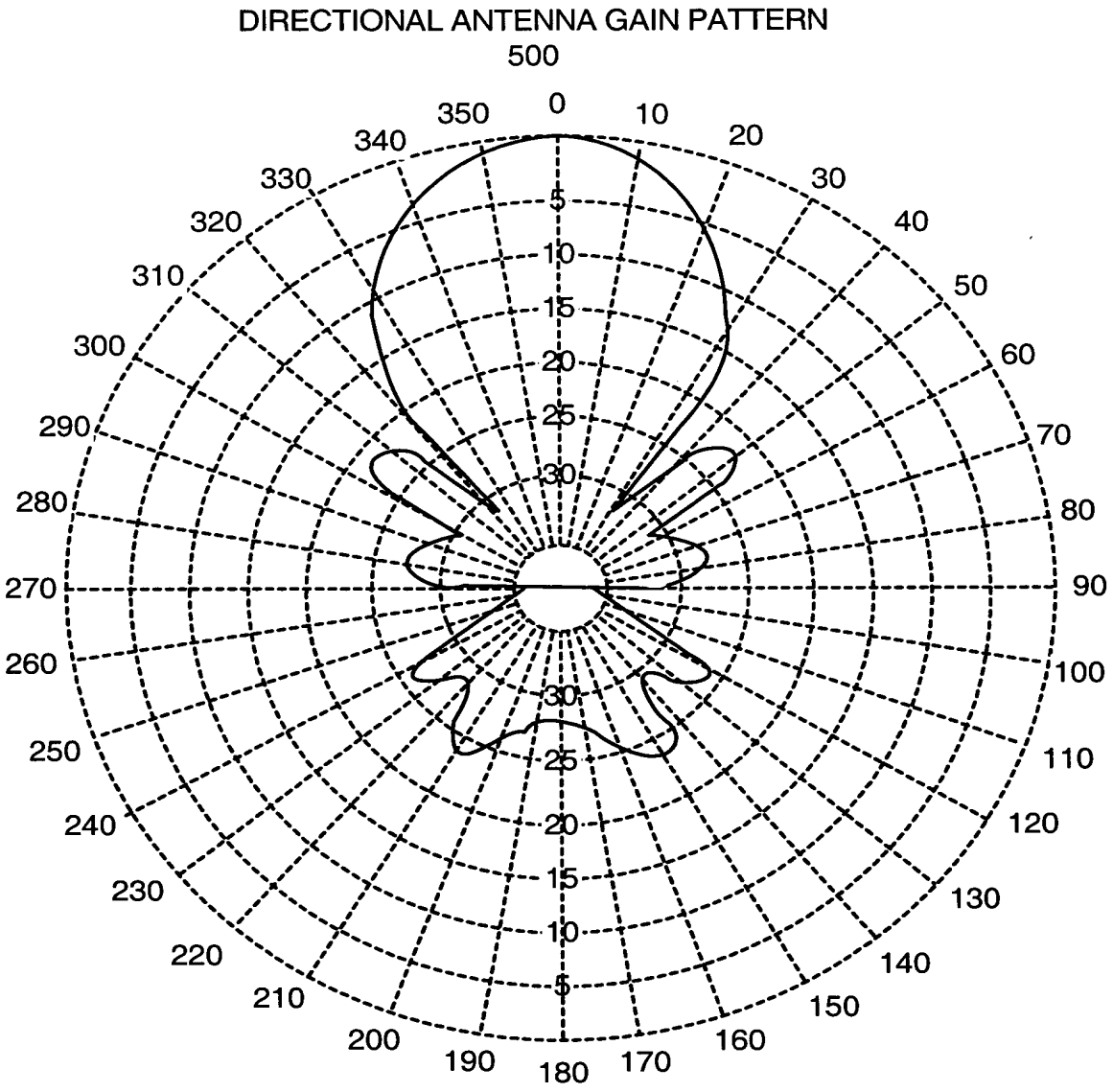
DIRECTIONAL ANTENNA GAIN PATTERN
500
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
5
10
15
20
25
30
30
25
20
15
10
5

FIG. 5

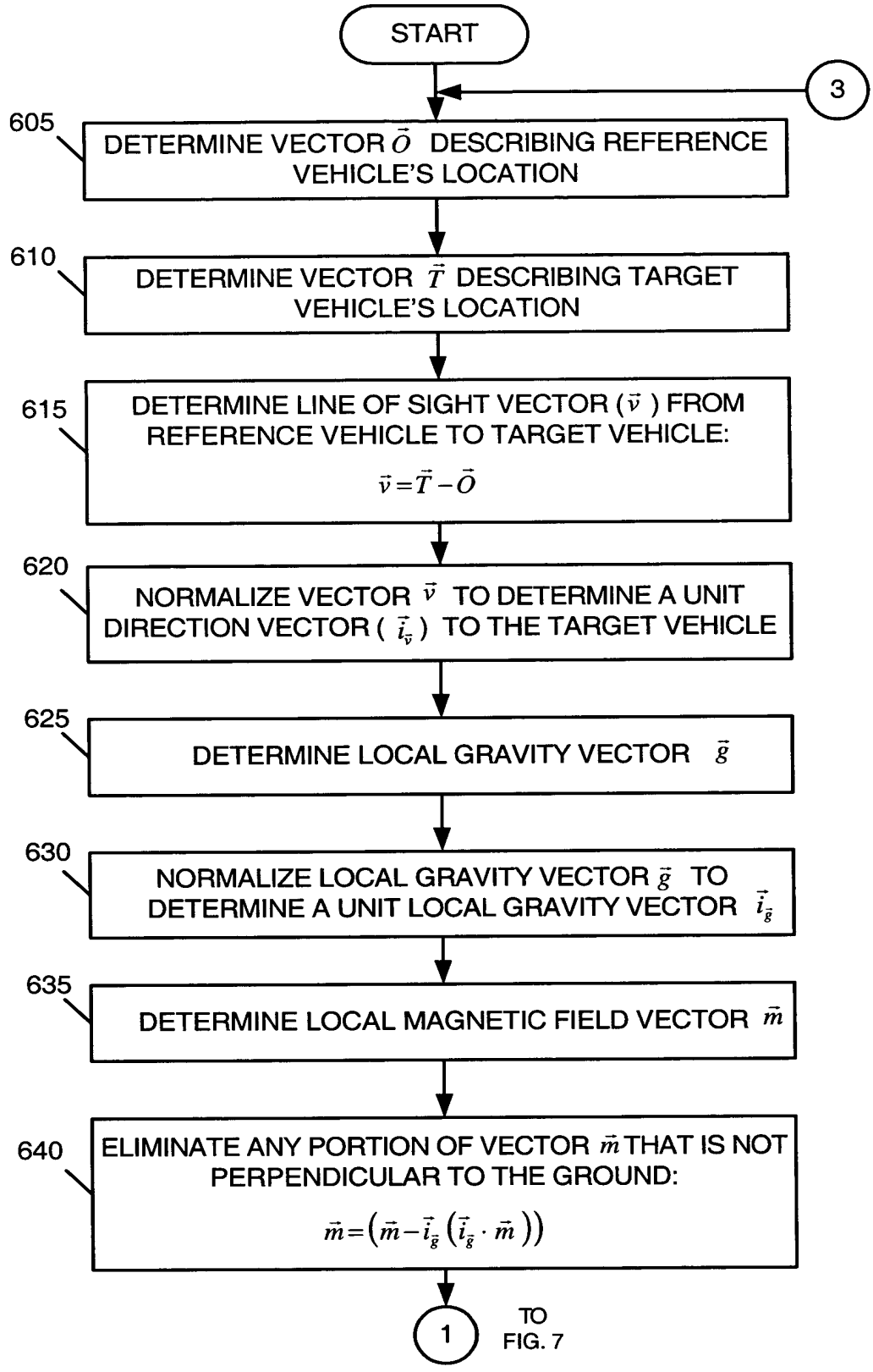
START
3
605
DETERMINE VECTOR $\vec{O}$ DESCRIBING REFERENCE VEHICLE'S LOCATION
610
DETERMINE VECTOR $\vec{T}$ DESCRIBING TARGET VEHICLE'S LOCATION
615
DETERMINE LINE OF SIGHT VECTOR ($\vec{v}$) FROM REFERENCE VEHICLE TO TARGET VEHICLE:
$\vec{v}=\vec{T}-\vec{O}$
620
NORMALIZE VECTOR $\vec{v}$ TO DETERMINE A UNIT DIRECTION VECTOR ($\vec{i}_{\vec{v}}$) TO THE TARGET VEHICLE
625
DETERMINE LOCAL GRAVITY VECTOR $\vec{g}$
630
NORMALIZE LOCAL GRAVITY VECTOR $\vec{g}$ TO DETERMINE A UNIT LOCAL GRAVITY VECTOR $\vec{i}_{\vec{g}}$
635
DETERMINE LOCAL MAGNETIC FIELD VECTOR $\vec{m}$
640
ELIMINATE ANY PORTION OF VECTOR $\vec{m}$ THAT IS NOT PERPENDICULAR TO THE GROUND:
$\vec{m}=\left(\vec{m}-\vec{i}_{\vec{g}}\left(\vec{i}_{\vec{g}}\cdot\vec{m}\right)\right)$
1
TO FIG. 7

FIG. 6

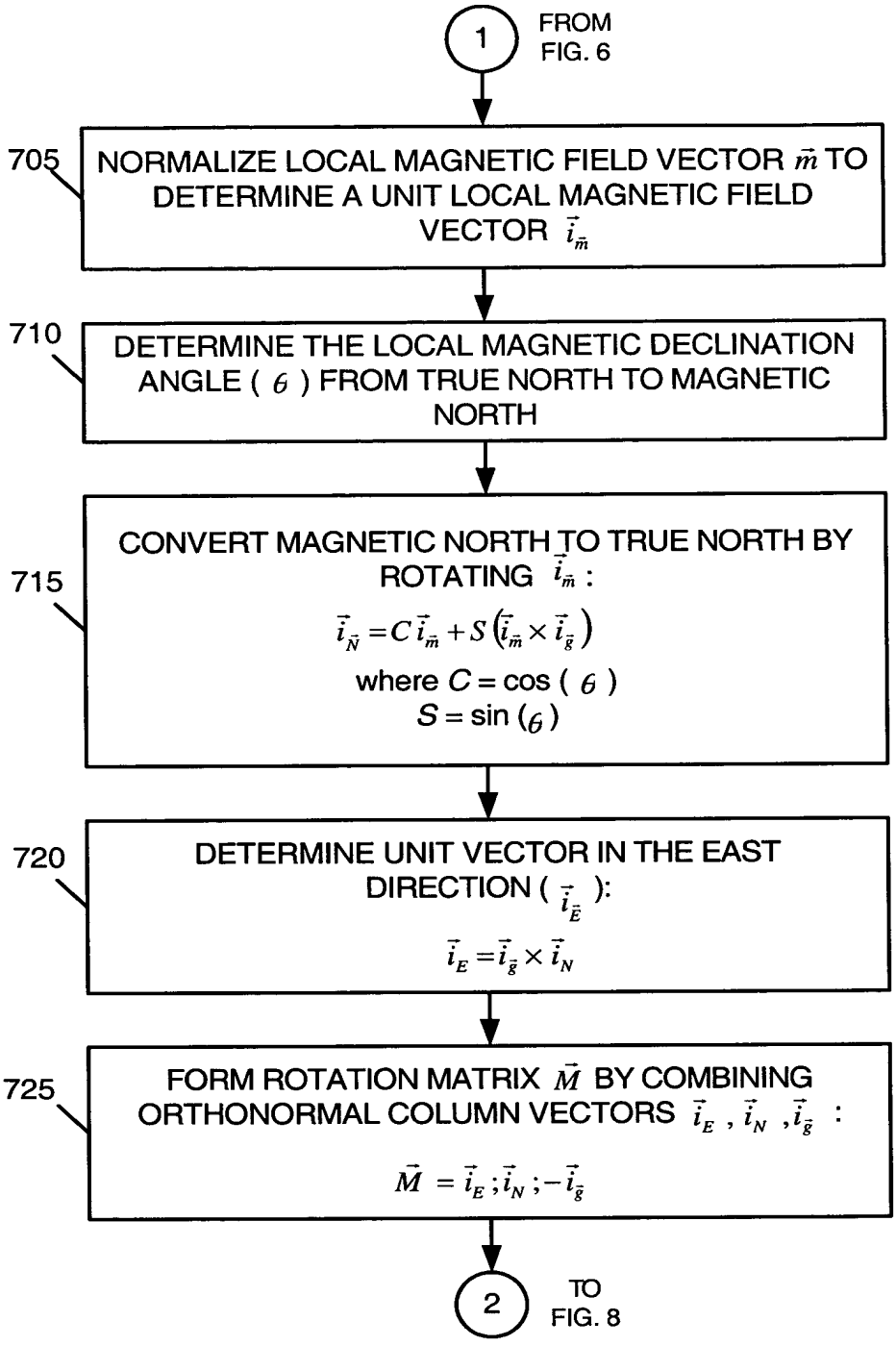
1
FROM FIG. 6
705
NORMALIZE LOCAL MAGNETIC FIELD VECTOR $\vec{m}$ TO DETERMINE A UNIT LOCAL MAGNETIC FIELD VECTOR $\vec{i}_{\vec{m}}$
710
DETERMINE THE LOCAL MAGNETIC DECLINATION ANGLE (θ) FROM TRUE NORTH TO MAGNETIC NORTH
715
CONVERT MAGNETIC NORTH TO TRUE NORTH BY ROTATING $\vec{i}_{\vec{m}}$:
$\vec{i}_{\vec{N}} = C\,\vec{i}_{\vec{m}} + S\left(\vec{i}_{\vec{m}} \times \vec{i}_{\vec{g}}\right)$
where $C = \cos(\theta)$
$S = \sin(\theta)$
720
DETERMINE UNIT VECTOR IN THE EAST DIRECTION ($\vec{i}_{\vec{E}}$):
$\vec{i}_E = \vec{i}_{\vec{g}} \times \vec{i}_N$
725
FORM ROTATION MATRIX $\vec{M}$ BY COMBINING ORTHONORMAL COLUMN VECTORS $\vec{i}_E$, $\vec{i}_N$, $\vec{i}_{\vec{g}}$:
$\vec{M} = \vec{i}_E ; \vec{i}_N ; -\vec{i}_{\vec{g}}$
2
TO FIG. 8

FIG. 7

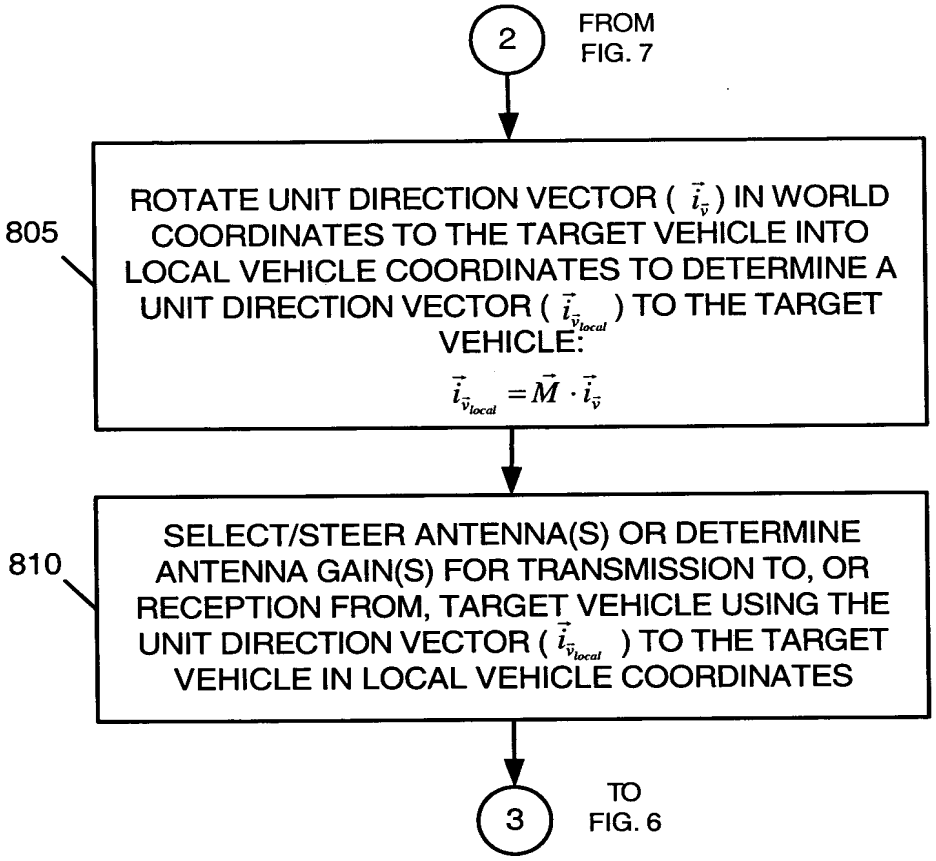
2
FROM
FIG. 7
805
ROTATE UNIT DIRECTION VECTOR ($\vec{i}_{\vec{v}}$) IN WORLD COORDINATES TO THE TARGET VEHICLE INTO LOCAL VEHICLE COORDINATES TO DETERMINE A UNIT DIRECTION VECTOR ($\vec{i}_{\vec{v}_{local}}$) TO THE TARGET VEHICLE:
$\vec{i}_{\vec{v}_{local}} = \vec{M} \cdot \vec{i}_{\vec{v}}$
810
SELECT/STEER ANTENNA(S) OR DETERMINE ANTENNA GAIN(S) FOR TRANSMISSION TO, OR RECEPTION FROM, TARGET VEHICLE USING THE UNIT DIRECTION VECTOR ($\vec{i}_{\vec{v}_{local}}$) TO THE TARGET VEHICLE IN LOCAL VEHICLE COORDINATES
3
TO
FIG. 6

FIG. 8